REMARKS / ARGUMENTS

Applicant acknowledges the Examiner's review of the specification, claims, and drawings. In light of the above amendments and following remarks, Applicant respectfully requests reconsideration of the present application. The amendments and remarks presented herein are fully supported by the application as originally filed. No new matter has been entered.

With regard to paragraphs 1 and 2 of the Office Action, the spelling errors have been corrected and replacement paragraphs are submitted herewith.

With regard to paragraphs 3 to 5 of the Office Action, claim 12 has been rearranged into a more conventional method claim format.

The present invention is concerned with an inspection system in which an image of an object to be inspected is captured, and the captured image data (which is effectively a two dimensional representation of the object) is then processed to generate three dimensional data representing the object.

Claim 1 has been amended to emphasize this aspect of the invention, and support for the amendment can be found, for example, paragraph [0038], second sentence, of the specification.

In order to generate the three dimensional data, the image data components must be projected into the object plane and, in the case of data components that relate to an edge of the object that is offset above the work surface, the data must also be adjusted as stipulated in claim 1.

Claim 1 has been amended to emphasize that it is data components that relate to an edge of the object that is offset above the work surface that are adjusted. Support for this amendment can be found throughout the specification, for example in paragraph [0090], second sentence.

An advantage of the invention of claim 1 is that it allows the three dimensional data to be generated without requiring multiple images to be taken, or relative movement between

the camera and the object, or the use of a scanning laser, all of which are considered to be expensive.

In contrast to the invention of claim 1, United States Patent 6,868,354 (Kosuge) relates to an inspection system with a travelling microscope (a microscope with a moving stage on which the object being examined lies – see column 4 lines 30 to 40, and a moving lens assembly – see column 5 lines 15 to 18) linked to a video camera. The object is inspected by moving the object relative to the microscope (in the XY plane) and moving the microscope relative to the object (in the Z plane). Hence, the inspection involves taking multiple images of the object. Kosuge's invention is more specifically concerned with how to recognize alignment marks on the object in order to facilitate the inspection (see the abstract, and column 1, lines 19 to 23).

It is noted in particular that Kosuge does not teach that the captured image data is used to generate three dimensional data representing the object in the manner of claim 1 – there is no need for Kosuge to do this because he has the benefit of multiple images of the object (by virtue of the relative movement between object and microscope described above).

With regard to US Patent 5,974,169 (Bachelder), this invention is concerned with recognizing characteristics, e.g. an edge, of an object in an image to facilitate the inspection and/or placement of the object (see column 1, lines 7 to 21 and column 3 lines 22 to 30). In particular, Bachelder's invention is concerned with creating "bounding boxes" to help identify the object's boundaries in the image (see abstract). In contrast with the invention of claim 1, Bachelder is not concerned with generating, from the captured image data, three dimensional data representing the object.

United States Patent 6,604,759 (Buckley) relates to conventional inspection systems of a first type shown in Figure 1, which uses a camera, a movable plate for moving the object under the camera, and a laser line scanning system (see Figure 1 and column 5 line 57 to column 6 line 5), or a second type shown in Figure 5 which uses multiple cameras for inspecting all sides of the object in a single pass (see Figure 5). In either case, Buckley uses triangulation as the means for constructing a model of the object (see column 5 line 65 to column 6 line 5) since multiple images are provided (either by the movement of the object

relative to the camera (as per Figure 1) or by the multiple cameras (as per Figure 5). Hence, the invention of claim 1 is redundant in a system such as that disclosed by Buckley.

Claim Rejections – 35 USC s 103

Applicant agrees with the Examiner that Kosuge fails to teach the following features of claim 1:

A. the processing apparatus is arranged to project each image edge data component onto the object plane to produce a respective object edge data component in the object plane

B. the processing apparatus is arranged to determine whether each object edge data component relates to an edge of the object that lies on the work surface or to an edge of the object that is offset above the work surface

However, Applicant submits that Kosuge does not disclose the following features of claim 1 either:

C. the apparatus is arranged to receive the image data components from the camera and to generate, using said image data components, three dimensional data representing the object

D. the apparatus is arranged to, upon determining that an object edge data component relates to an edge of the object that is offset above the work surface, adjust the value of the object edge data component by an amount depending on the ratio of the size of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane.

With regard to feature C, as explained above, Kosuge is not concerned with generating a three dimensional representation of the object. Rather, it is concerned with recognising alignment marks in the image of the object.

With regard to feature D, since Kosuge does not disclose feature A, then it cannot disclose feature D since feature D is concerned with object edge data components, i.e. image components projected into the object plane. Also, since Kosuge does not disclose feature B, then it cannot disclose feature D since feature D is dependent on feature B. Also, adjusting

the value of the object edge data component depending on the detected offset as required by feature D has no meaning in the context of Kosuge's invention since this is only necessary when trying to generate a three dimensional representation of the object.

It is respectfully noted that feature D has nothing to do with adjusting the field of view of the camera as suggested by the Examiner in page 4 of the Office Action. This can be appreciated by noting that the adjustment is dependent on the size of the offset in a direction generally perpendicular with the work surface. Claim 1 has been amended to emphasize this by stipulating that the offset is "above" the work surface.

With regard to Bachelder, Applicant respectfully disagrees with the Examiner that Bachelder discloses feature A. As indicated above, Bachelder is not concerned with generating, from the captured image data, three dimensional data representing the object. Therefore, Bachelder has no need to project image data components into the object plane. The labelling of the boundary points highlighted by the Examiner on page 5 of the Office Action is performed on the two dimensional image data. This can best be appreciated from Figures 2 and 3 of Bachelder and the accompanying description.

Applicant respectfully disagrees with the Examiner that Bachelder discloses feature B. Bachelder only discloses determining whether or not an image point appears to lie on a boundary of the object and then ignoring the point if it lies outside of the bounding box (column 2 lines 31 to 34). The bounding box is a notional two dimensional construct created on the image (see column 2, lines 22 to 29) and has nothing to do with the work surface, or with object edge data components, i.e. image components projected into the object plane. The introduction of the word "above" into feature B emphasizes this difference.

It is noted that Bachelder does not disclose features C or D either, for reasons similar to those given in respect of Kosuge.

Accordingly, since neither Kosuge nor Bachelder disclose any of features A to D of claim 1, their individual or combined teachings could not lead a skilled person to the invention of claim 1. It is respectfully submitted therefore that claim 1 is novel and non-obvious in the light of the teachings of Kosuge and Bachelder.

Similar comments apply in relation to independent claims 11 and 12 which are of similar scope to claim 1.

It is further submitted that claims 2 to 10 and 13 are also novel and non-obvious in the light of Kosuge and Bachelder in view of their dependencies on claim 1 or 12.

With regard to claims 2 to 8, Applicant respectfully disagrees with the Examiner that Kosuge or Bachelder disclose the subject matter of these claims. The features of these claims are dependant on one or more of features A to D above and, as such, are meaningless in the context of Kosuge's or Bachelder's teachings.

With regard to claims 9 and 10, as explained above, Buckley employs a system that uses one camera and a laser line scanner, or multiple cameras to produce its object model using triangulation. This is a conventional solution which, as indicated in paragraphs [0004] to [0007] of the present application, is considered to be expensive. Buckley is therefore fundamentally incompatible with the claimed invention and would lead a skilled person away from the invention. Moreover, Buckley does not disclose the features of claims 9 and 10 - these features are irrelevant to Buckley since he uses triangulation techniques.

It is respectfully submitted that the Application is in order for allowance.

Should the Examiner have any questions or suggestions, he is invited to contact the undersigned at (616) 975-5506 or at collins@vglb.com.

Respectfully submitted,

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